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Arhopalus productus (Lec.)
A BORER IN NEW BUILDINGS

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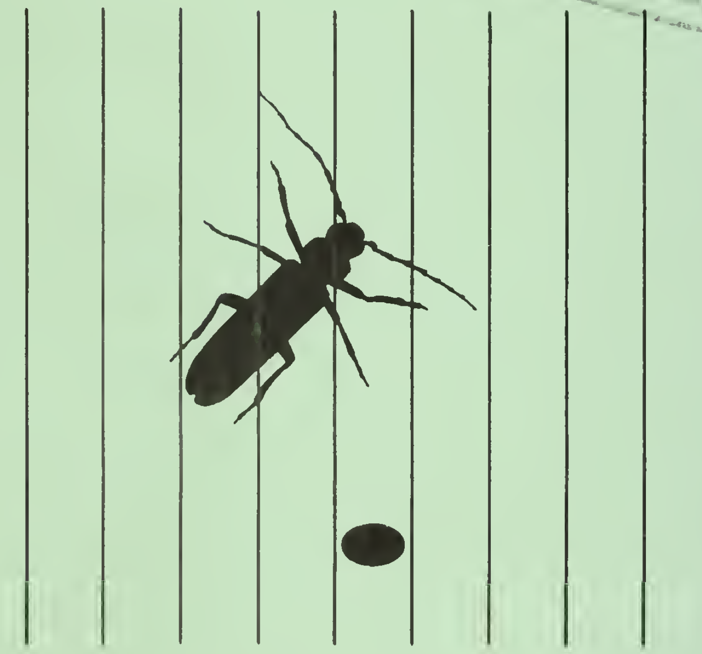

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ARHOPALUS PRODUCTUS (LEC.), A BORER IN NEW BUILDINGS

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ARHOPALUS PRODUCTUS (LEC.), A BORER IN NEW BUILDINGS

By C. B. Eaton and R. L. Lyon

Arhopalus productus (Lec.) is a wood-boring beetle that infests dead or dying coniferous trees. The species has been known for more than a century but for many years has remained in relative obscurity. Since the 1930's, however, the borer has gained considerable notoriety on the West Coast because of its ability to complete development and emerge from infested lumber in new buildings. Reports from lumber suppliers, building contractors, and owners of new homes indicate that the source of most of the damage is Douglas-fir lumber cut from fire-killed, insect-killed, and windthrown trees.

The damage in buildings consists mainly of emergence holes made by the newly formed adult beetles when they complete their life cycle and bore out of the wood. Their borings are rarely, if ever, extensive enough to seriously weaken a structure, and the insect does not reinfest the lumber. But, when the beetles emerge through hardwood flooring, plasterboard on walls or ceilings, composition roofing, or other materials covering infested wood, the holes that they leave are unsightly. Furthermore, the holes are sometimes difficult and costly to repair, and often are a source of great concern to building owners.

Entomologists and foresters are often confronted with requests from the building industry and from home owners for information about the habits and control of the borer. This article has been prepared to help in providing answers to these inquiries. It brings together from the literature and from unpublished records in the files of the California Forest and Range Experiment Station what is known about this insect.

THE INSECT

Arhopalus productus belongs to the long-horned beetle or roundheaded borer family, Cerambycidae. The species was described by LeConte (9) in 1850 from a single specimen taken in Oregon. It was originally placed in the genus Criocephalus; however, in 1940, Linsley (10) found that Criocephalus and Arhopalus were synonymous, and clarified the priority of Arhopalus. According to Craighead (2), Arhopalus (Criocephalus), Asemum, and Megasemum (Nothorhina) are closely related genera, inseparable in the larval stage on the basis of generic characters.

The adult is a narrow, black beetle from 3/4 to 1 1/4 inches long (fig. 1, A). The larva is yellowish-white, and when mature is about 1 1/2 inches long (fig. 1, B). Characters for separating the larva from closely related species are given by Craighead. The most distinctive are the caudal spines on the ninth abdominal segment, which are acutely conical in shape and slightly incurved toward each other. The pupa is similar to the pupae of other members of this group except that *Arhopalus productus* has a sparse, whitish pubescence on the prothorax.

RANGE

The borer is distributed throughout most of western United States and western Canada. Some authors refer to its range as being the Rocky Mountains and Pacific Coast regions (2, 3). Essig (4) lists its occurrence in New Mexico, Colorado, California, Oregon, Washington, and British Columbia. Unpublished records show that various workers have collected the insect in California, Oregon, and Montana. The literature also records specific collections from Alberta (1), Washington (11), Utah (8, 11) and Colorado (11).

HOSTS

The principal host of *Arhopalus productus* is Douglas-fir (*Pseudotsuga menziesii* (Mirb.) Franco). This is the host most commonly listed in the literature (2, 4, 6); moreover, most reports of damage in buildings by this insect show Douglas-fir to be the source of infestation. The borer is also recorded as breeding in pines (*Pinus* spp.) and true firs (*Abies* spp.), but very little is known about its attacks on tree species in these two genera. One collection was taken from ponderosa pine (*Pinus ponderosa* Laws.) by F. P. Keen in 1926, and another from the same host in 1927.

Most observers agree that the host tree must be dying or dead before it is in suitable condition for attacks by the beetle. Whether attacks also are made on down or decked green logs is not known. The availability of dying or dead trees depends to a considerable extent upon how frequently other agencies, such as fire, wind, or other insects, become destructive. These agencies are probably important in determining which host species is most frequently attacked. Although Craighead (2, p. 33) reports the beetle as "being often found mining under the bark of trees infested by *Dendroctonus*," observations made by others suggest that it may breed more frequently in fire-killed hosts. Furniss (5) observed that the adults are sometimes attracted to burned trees before the trees have ceased to smoulder. The species has been reared from the wood of dead or dying trees on recently burned

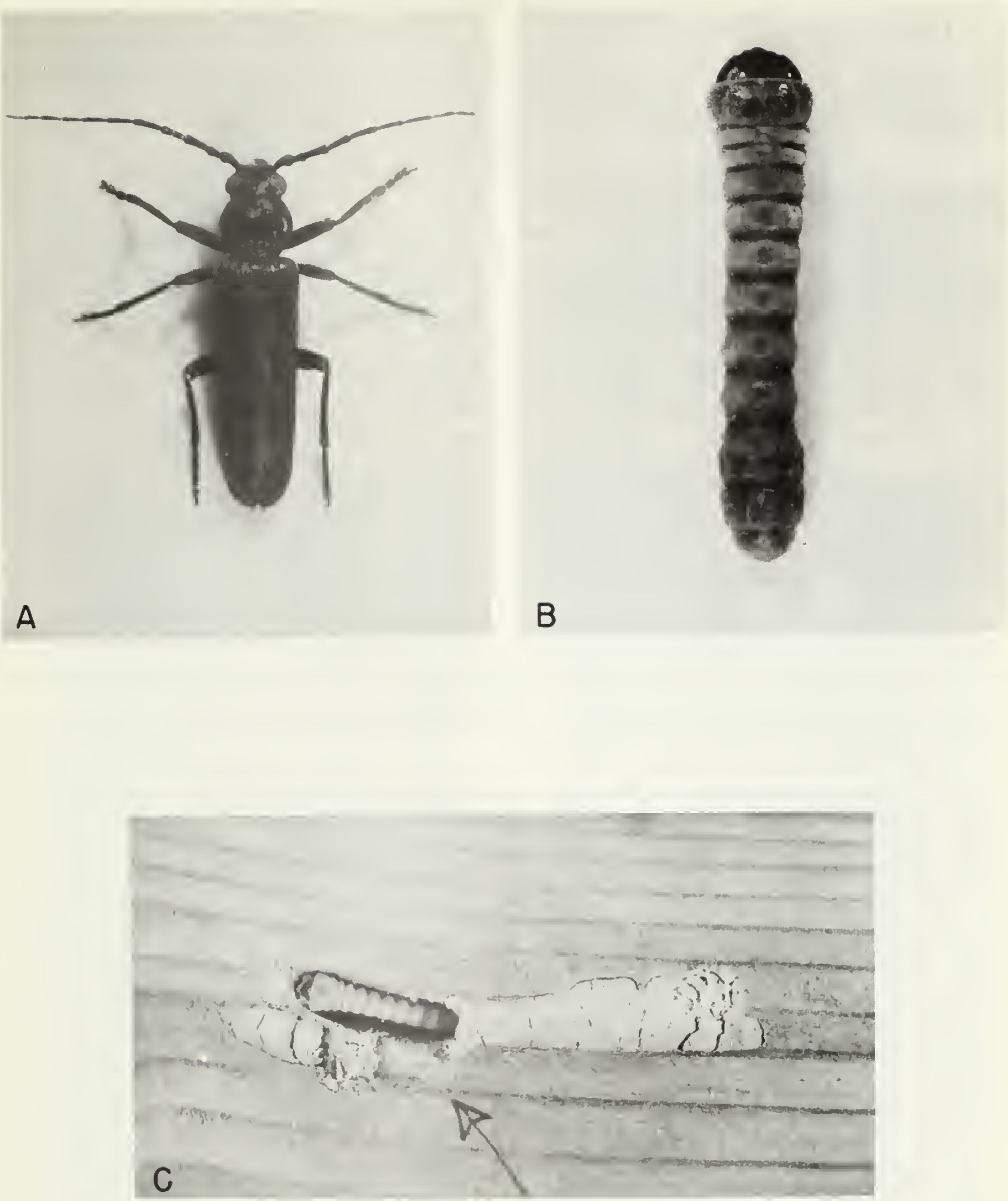

Figure 1. *Arhopalus productus*. *A*, adult male, 2x; *B*, full-grown larva, 2x; *C*, larva in pupal cell in wood, natural size.

areas. In Douglas-fir killed by fire, the beetle is important as a contributor to the deterioration of the wood (7).

BIOLOGY

Present knowledge of the habits of this borer is very limited and is based almost entirely on observations of the beetle in burned timber.

Attacks on fire-killed trees probably take place during the first summer after a fire. They occur characteristically on the upper bole of the tree, although the basal portion may be infested (7). The female beetles lay their eggs in deep crevices of the bark. Upon hatching, the young larvae bore through the bark to the sapwood, where they feed for a time, scoring the outer surface of the sapwood and inner surface of the bark. The work of the larvae is similar in many respects to the work of the pine sawyers (Monochamus spp.). The initial feeding results in the formation of large depressed areas on the surface of the sapwood; these areas are choked with coarse, excelsior-like shavings. Later the larvae enter and mine within the sapwood and then penetrate the heartwood, forming galleries that are tightly packed with fibrous frass (fig. 3). In lumber the larvae sometimes tunnel from one piece of wood to another, if the two pieces touch. In lumber also, a larva will occasionally bore to the surface of the wood, then plug the hole at the surface, retreat, and continue mining in the interior.

When the larvae are full grown, they construct large open pupal cells (fig. 1, C). These cells may be so numerous and extensive as to severely limit the salvageability of the wood, or render it useless as lumber.

After pupation takes place, the adult beetles bore their way out of the wood, making clean-cut oval exit holes at the surface (fig. 2). Each hole marks the exit point of a single beetle. When the beetles emerge in houses, they chew their way through many different types of material overlaying infested wood. For example, they have bored through hardwood flooring, linoleum, plasterboard, and composition roofing.

Very little is known about the length of time required for this species to go through a complete cycle of development, or about the duration of the different life stages. Craighead (2) states that the larvae probably spend at least 2 years feeding in the heartwood. Kimmey and Furniss (7) concluded that the insect takes several years to reach maturity. They found larvae

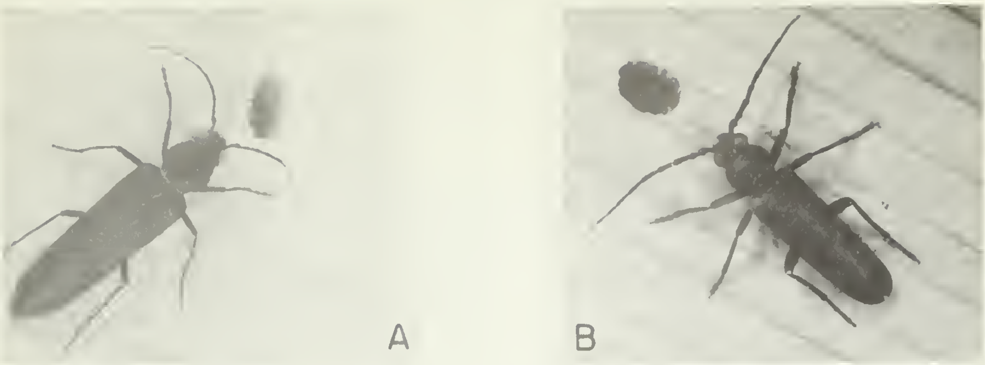

Figure 2. Emergence holes made by adults through plasterboard and Douglas-fir wood. A, female on plasterboard; B, male on wood.

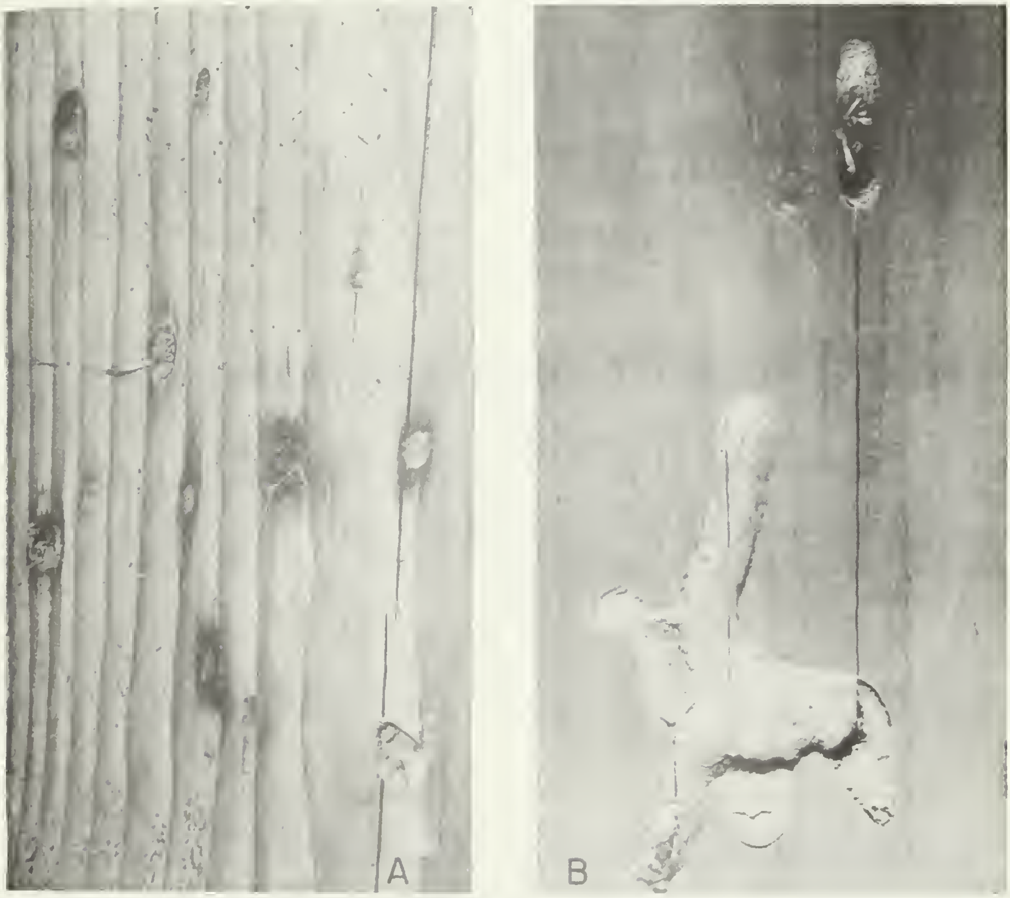

Figure 3. Larval tunnels packed with borings in Douglas-fir. A, board with several tunnels in cross section (Photo courtesy R. D. Hodges); B, longitudinal section through part of tunnels.

constructing pupal cells in fire-killed Douglas-fir from 3 to 6 years after fire. The larvae commonly occur in trees that have been dead for 10 years. Evidence that the beetle does not reattack fire-killed trees, once such trees have become infested, is not conclusive. Records of this beetle in ponderosa pine indicate that not less than 2 years are required for development.

Although the evidence suggests a fairly long life cycle in nature, it does not appear that infestations persist in buildings for long periods of time. The adults usually emerge within a few months after construction is completed. Reports are rare of continued emergence a year or more after a building has been occupied. It is probable that once a house is heated and the wood dries out, conditions become unfavorable for larval development, and only those insects that are nearly full grown are able to reach maturity. In their natural habitat, borers of this type are reported by Craighead (2) to require wood with a fairly high moisture content in order to develop successfully.

Arhopalus productus does not attack wood that has been converted into lumber. Consequently there is no hazard of reinfestation in a house where the beetles appear. Like many other wood-boring species to which it is closely related, the insect requires wood with the bark in place in order to establish itself successfully.

EXAMPLES OF DAMAGE

The emergence of the borer from infested framing, sheathing, and construction timbers in new buildings has been a recurring problem on the West Coast for more than 30 years. Since the late 1930's, when lumber salvaged from fire-killed Douglas-fir on the Tillamook Burn in Oregon began to appear on the market (5), the number of complaints about this borer has been on the increase. Records concerning the emergence of the borer in buildings contain many examples indicating that the insect is most commonly little more than a nuisance problem. However, cases have occurred where the exit holes made by the beetles led to serious consequences. Examples of these are cited because they not only shed some light on the insect's behavior, but also help give perspective to the problem.

One of the most serious cases of beetle damage was one that involved a large warehouse in San Jose, California. An industrial building contractor erected the warehouse for a manufacturing concern during the latter part of 1951. In the spring of 1952, Arhopalus productus emerged through the roof surface from infested lumber used in the roof sheathing. The roof was constructed of 2- by 6-inch, tongue and groove Douglas-fir lumber with a protective covering of composition roofing. After boring their way out of the wood the beetles made holes through this covering, causing the roof to leak during the rainy fall months of 1952.

One of the most common sources of trouble is the 2-inch tongue and groove lumber. This material is being used rather widely at the present time for subflooring. In a number of new houses in a tract at Concord, California, beetles emerged from infested subflooring made of 2-inch lumber in the spring of 1953. They bored through both hardwood flooring and linoleum with which the subfloor was overlain. The subflooring in the houses was Douglas-fir, and there was some evidence that it came from a fire-killed stand. In this instance the problem was of the nuisance variety, for the average number of visible emergence holes per house was only 4, with a range of 1 to 8 for 8 houses examined.

The beetles sometimes emerge from infested wood framing in the walls or ceilings of buildings and bore out through the covering material. In a newly-built house in San Mateo, California, beetles in Douglas-fir studs chewed their way through the plasterboard with which the studs were covered (fig. 2). In a house in San Francisco they emerged from infested studs and bored through plaster on the interior walls. In this one building a total of 34 exit holes were counted in the plaster. Many similar cases of damage by this insect have been recorded.

CONTROL

Borer infestations in buildings are practically never extensive enough to cause serious mechanical weaknesses in a structure. However, they may have other undesirable consequences such as those that already have been cited. Their nuisance value alone is great enough to generate some doubt among lumber users about the wisdom of using lumber that may be infested. For this reason, action should be taken wherever practicable to prevent the borer problem from arising.

The best time to control the beetles is at some stage in the manufacture or processing of lumber, before it becomes part of a finished structure. Once infested wood is built into a building, the prospects of keeping the insects from completing their development are poor.

Steps to prevent damage begin in the woods. The disposal of timber likely to be attacked should be expedited. Especially susceptible timber includes fire-killed, windthrown, or insect-killed trees. Such material should be manufactured into lumber as quickly as possible after the trees die, before the borers have had a chance to penetrate deep into the wood. If the wood is converted into lumber while the larvae are in the early stages of development, most of the insects will be in the slabs and edgings and will be destroyed when these are disposed of.

Often it is not possible to salvage trees before the borers have worked their way into the wood, especially when catastrophes occur in which large quantities of timber are killed, or when adverse economic conditions prevail. In such circumstances, by the time the lumber can be cut from the trees it is liable to be infested. When this happens, steps should be taken either to channel infested lumber to uses where the insects will not be a nuisance, or to get rid of the borers.

Lumber suspected of being infested should be examined carefully for evidence of borer work. This is an important step, for many cases of damage in buildings can be laid to the use of very small amounts of infested wood intermingled with sound material. Lumber in which the borers may be working, usually will have at least part of the larval galleries exposed (fig. 3), although this is not always the case. When pieces showing insect work are found, they should be separated from those that are free of injury.

Heat is an effective method for controlling roundheaded borers in lumber (12), and kiln-drying by the usual commercial schedules will kill the insects. For 1- and 2-inch Douglas-fir lumber, either green or air-dry, a heat sterilizing treatment in the dry kiln at a temperature of 140° and a relative humidity of 75 to 80 percent for a period of 6 to 8 hours is recommended. Since most of the cost of kiln-drying is in piling the lumber, loading and unloading the kiln, and unpiling, an overnight treatment (12 to 14 hours) in the kiln is advisable to make sure that all borers are killed. The longer treatment is required for material thicker than 2 inches.

Insecticides that might be used either as sprays or dips or by brush applications to treat lumber so as to control the larvae have not been tested against Arhopalus productus.

As stated earlier, little can be done to prevent beetles from completing their development in a building containing infested lumber. Fumigation with methyl bromide has been attempted in a few cases, but no experimental evidence is available to show how effective the method is against this particular insect. Since the insects are usually embedded in tunnels packed with borings deep in the wood, fumigants must be able to penetrate to them in order to exert any killing effect. Fumigation is a laborious and costly process. Because of this fact, and because the effectiveness of fumigation is questionable, it usually is simpler to plug and repair the holes made by the beetles.

The adults leave the wood permanently when they work their way to the surface. Therefore, insecticides introduced through the exit holes are of no value. Occasionally the larvae chew to the surface, then turn back into the wood. When this happens, the insect can sometimes be killed by probing into its burrow or introducing a small quantity of fumigant with an eye dropper.

DISCUSSION

Borer-infested lumber is undoubtedly a very small fraction of the 10 billion board feet of Douglas-fir being marketed each year. Nevertheless, the occurrence of infested material in houses, even in small amounts, has some implications that are potentially serious to timber producers. The home owner who sees beetles coming out of the floors and walls of his new house is not easily persuaded to the view that the insects are simply a nuisance. He is likely to seek redress through legal action against the builder for furnishing substandard materials. To the builder or others who must repair or make good the damage, the problem is likewise quite real. In the export trade there are also some hazards. Shipments containing appreciable quantities of infested lumber could give rise to quarantines or trade barriers that would make it difficult to dispose of any lumber that might harbor borers. Thus, potentially at least, the small proportion of infested lumber now reaching the market is a threat to the entire industry.

Borer damage is liable to occur more frequently in the future than it has in the past unless greater effort is made to prevent infested lumber from being used in buildings. The increased value of wood has made it profitable to log trees that once would have been left to be decomposed by insects and fungi. Furthermore, salvaging dead or dying trees is good conservation and good forest management if adequate steps are taken to insure that the products from such trees are suitable for the purpose intended. In harvesting mature or overmature stands, foresters are giving priority to areas where large quantities of timber have been struck down by fire, wind, or other agents. Disturbances of this nature have been especially common in Douglas-fir stands of the Pacific Coast in the years since 1950, and have given rise to an extensive salvage program. Thus, it does not seem likely that production of lumber which is infested by borers will diminish in the near future. On the contrary, it is likely to increase.

Present information on the habits of this borer is fragmentary at best. Before satisfactory control methods can be developed, a much better knowledge of the insect's biology must be obtained. Also needed are better facts regarding the tree species and types of host material that the borer will attack. To establish the economic importance of the problem, quantitative information is needed on the occurrence of the borer in lumber and in new buildings. Finally, other methods than kiln drying need to be developed to control the insect in infested material.

SUMMARY

Arhopalus productus (Lec.) is a wood-boring beetle that is occasionally a pest in new buildings. It causes damage by making holes in floor, wall, or roof materials when emerging from infested framing timbers. Its work in buildings is never so extensive as to seriously affect the structural strength of the wood. However, in fire-killed trees this species is an important cause of wood deterioration.

The borer occurs in most parts of western United States and western Canada. It breeds in dead and dying coniferous trees, especially Douglas-fir, and becomes a nuisance in houses where lumber cut from such trees has been used. Emergence of the adult beetles in houses usually takes place within a year after a house is built. The insect does not attack wood manufactured into lumber, and damage does not continue after the adults have emerged. The biology of the beetle is not well known. The life cycle in nature probably takes 2 to several years.

Effective methods are not known for controlling an existing infestation in a building. To prevent damage, lumber suspected of being infested can be examined, and the wormy material sorted from the sound. The infested lumber can then either be kiln-dried to destroy borers, or channeled to uses where the emergence of beetles would be no problem.

Emergence of the borer in buildings is principally a nuisance problem, but it is one that is potentially of considerable consequence to the lumber industry.

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